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Re: **Docket No. G-01551A-04-0876; Decision No. 68487**

Pursuant to Commission Decision No. 68487 in the above referenced docket and subsequent discussions with the Arizona Corporation Commission Staff (Staff), Southwest Gas Corporation (Southwest) hereby submits for filing an original and thirteen (13) copies of Southwest's Research Allocation Plan for 2010 (Plan).

Finding of Fact No. 37 of the Decision states that..."Gas Research should be funded at the level recommended by Staff, but Southwest Gas should have the flexibility, subject to Staff oversight, to select appropriate entities for use of the research funds." The submitted Plan provides a list and description of the research programs to be funded by Southwest between April 2010 and March 2011.

In past filings, Southwest provided a list of projects that were intended to be funded for the particular program year. However, there were no updates to reflect the actual projects funded. Based on discussions with Julie Mcneely-Kirwan of the Commission Staff, a reconciliation report reflecting actual projects funded would help simplify Staff's review of Southwest's Plan. The enclosed report reflects a new format that includes: the projects to be funded in 2010-2011, the requested reconciliation of projects, and a history of all the projects funded to date. Southwest will use this new format for its annual filing unless Staff has any concerns or suggestions for revisions.

#### Program Highlights

##### *Transmission Integrity Management*

Southwest continues to fund projects to help meet transmission pipeline integrity management requirements, imposed by the Pipeline and Hazardous Materials Safety Administration (PHMSA); projects that have the potential to not only meet the requirements, but also to help reduce costs in complying with them. Three key projects are listed below.

- OTD-24, 4" MFL Tethered Inspection Tool for Unpiggable Pipe
- OTD-25, Inspection Platforms for Unpiggable Pipe
- NYS-9, Explorer Demonstration in AZ (robotics demo)

Integrity management requires that certain transmission pipelines be assessed by either in-line inspection (referred to as smart pigs), pressure testing, or direct assessment (a combination of over the pipe surveys with direct exams). Most of Southwest's transmission pipelines that are covered under the regulations can not accommodate traditional in-line inspection tools as they require relatively long straight pipe sections. Southwest's transmission systems traverse populated areas in city streets, are segmented (not one continuous system), and are not long and straight. These pipelines are "unpiggable". The projects listed above hope to develop in-line inspection tools that can be used in unpiggable pipe.



April 5, 2010  
Docket Control Center  
Page 2

### *Biogas*

A relatively new program area that Southwest has funded or is currently funding, is related to renewable natural gas sources from dairy farms, landfills, and wastewater treatment plants. Renewable natural gas is often referred to as "Biogas". The key projects related to these efforts are listed below.

- OTD-43, Biogas Guidance for Dairy Waste
- OTD-44, Biogas Guidance for Landfill and Water Treatment Facilities
- OTD-45, Biogas: Siloxane Concentrations
- OTD-48, Trace Constituents

The key issue with all biogas sources, is that in their raw form, they contain numerous contaminants that may affect pipeline systems and end-use appliances. These contaminants have to be removed so that the "gas quality" is adequate to put back into a pipeline distribution system. The challenge however, is that all biogas contains different contaminants and different levels of contaminants. In addition, the impacts of the various contaminants on pipeline systems and end-use equipment have not been thoroughly investigated. The projects listed above hope to address these challenges so that Southwest and others have a better understanding of what can (or cannot) be safely introduced into the pipeline system.

### *Energy Efficient Technology*

For this program year (2010-2011), a demonstration effort utilizing natural gas engine driven heat pumps (referred to as gas heat pumps, or GHPs) is planned in Phoenix or Tucson. GHPs provide space heating and cooling utilizing natural gas which can significantly improve overall energy efficiency and reduce greenhouse gas emissions, particularly when considering the full fuel cycle. GHPs demonstrate that it is more efficient to use natural gas at the site (house or building) than using it as a fuel at a power plant to generate electricity for an electric air conditioner.

Data obtained from this effort will help establish benchmarks on savings potential and help provide a basis for future DSM programs.

In closing, if you have any questions or require any additional information, please contact me at (702) 876-7163.

Respectfully submitted,

A handwritten signature in black ink that reads "Debra S. Gallo".

Debra S. Gallo, Director  
Government & State Regulatory Affairs

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**Southwest Gas Arizona Research  
Summary Report  
April 1, 2010**

Ref. Number	Organization/Project Name	Research Performer	Project Description	Potential Benefits to AZ Customers	Status	Apr '06 - Mar '07 Funding	Apr '07 - Mar '08 Funding	Apr '08 - Mar '09 Funding	Apr '09 - Mar '10 Funding	Apr '10 - Mar '11 Funding
	<b>Operations Technology Development (OTD) Program Dues (Project Allocation and Administrative Costs)</b>									
	Carry over from previous year					\$430,000	\$430,000	\$430,000	\$430,000	\$216,108
	<b>Total Available for Allocation</b>						\$268,500	\$91,360	\$115,082	\$233,892
OTD-0	OTD Administrative Costs	GTI					\$698,500	\$521,360	\$545,082	\$450,000
OTD-1	(1.6.h) Complete Project Development and Field Testing of the Digital Leak Detector	GTI	The objective of this project is to develop and commercialize a leak detection and pinpointing digital leak detector (DLD) that is proven in multi-utility applications. The DLD detects the acoustic signal created by the gas or fluid escaping the pressurized pipe.	Improved accuracy in pinpointing hard to find leaks. In addition, reduced costs in pinpointing leaks.	Final report available. Effort proved DLD can work for leak pinpointing but further work is required for commercialization	\$40,000	\$18,120	\$7,550		
OTD-2	(1.7.a) Complete - Universal Utility Locator	GTI	The objective of this project is to develop a prototype locating system that is able to locate plastic and other non-metallic pipes in a variety of soil conditions. The prototype will also be able to provide information about depth, diameter and material composition of the pipe.	Reduced costs in locating non-metallic pipe.	Final report available. Technology did not prove to be appropriate or applicable.			\$20,000	(\$11,365)	
OTD-3	(1.7.b) CANCELED Low-Cost, Nano-Methane Sensor	GTI			Project cancelled			\$0		
OTD-4	(1.8.g) Acoustic Sewer Lateral Locator	GTI	Trenchless pipe installation techniques greatly reduce natural gas pipe installation costs and minimize impact to the environment and general public. Unfortunately, there have been occasions where a gas plastic pipe has been unintentionally installed through a sewer lateral and the operator is unaware of this situation. The intent of this project is to develop acoustic tools/processes. The key challenges to address include: 1) operations in all types of soil under various operating conditions, 2) cost effectiveness of the device, and 3) ease of operation by field crews.	Enhanced safety through a more accurate method of locating sewer laterals. In addition, reduced costs in locating sewer laterals.	This project is still active and is related to the hand-held acoustic locator, OTD-5 (1.h)				\$15,000	\$14,368

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OTD-5	(1.h) Hand-held Acoustic Pipe Defector (Phase II & III)	GTI	The objective of this project is to design, build and test a commercial-grade (Phase III), handheld pulse-echo sonic detector capable of detecting and locating small diameter metallic and nonmetallic pipe in all soil types.	Reduced costs in locating non-metallic pipe.	A new commercializer is being identified. Further testing is required and additional funding may be required. Some testing has taken place to date and so far, performance has shown this to be a viable technology.	\$15,000	\$11,893		\$10,902	
OTD-6	(2.7.b) Qualification of Saddle and Electrotusion Joint Designs and Test Methods to Validate Safe Long Term Performance	GTI	The objective of this project is to develop a novel approach to ensure the safe and long-term performance of various types of lateral connections including: saddle heat fusion joints, electrotusion joints, and mechanical joining.	Improved joining procedures and/or joint evaluation, to ensure long term joint integrity	Phase I complete, Phase II starting in '09 - '10. Report pending for Phase I	\$25,000	\$12,500	\$15,000	\$15,000	
OTD-7	(2.7.d) Cold Adhesive Repair (CAR) and Joining of Polyethylene Pipes with Minimal Surface Preparation	GTI	The primary objective of this project is to develop and commercialize an economical, reliable, and safe technology to quickly and effectively repair damaged and leaky PE gas pipes using modern structural cold adhesives, optimized for low-surface-energy materials such as PE, that require little surface preparation, cure at typical field temperatures, cure within short periods not exceeding 90 minutes, and do not require any tools, heating, pressure or significant training.	Reduced costs in repairing damages to plastic pipe.	On-going. No additional funding is required at this point.	\$10,000	\$9,268			
OTD-8	(2.7.e) External Repair Tool for PE Pipe	GTI	The overall objective of this project is to continue the research that Timberline has already conducted to: optimize the design of the repair patch and repair patch material, optimize the design of the mechanical tool to apply the repair patch, and perform appropriate testing and address regulatory codes for the repair patch to be accepted as a repair method for PE pipe.	Reduced costs in repairing damages to plastic pipe. Enhanced safety by allowing the repair of damaged plastic pipe from above ground (i.e. not in the ditch)	Draft final report available. Technology commercialized but further demonstration required. Phase II in 2010 for further demo.	\$45,000	\$32,936			\$10,000

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OTD-9	(2.7.g) Composite Pipeline Repair Systems - Analysis of Adhesive Degradation Permanence of Repair	GTI	This project will include the evaluation or the adhesives used in commercially available composite used in commercially to establish if their performance dictates a "permanent" or "temporary" repair classification for the overall repair system. Composite repairs depend heavily on the adhesive system from the repaired pipe to transfer the load system. In order to fully assess the permanent or temporary repairs (as the possibility of degradation solutions), investigated over time must be	Enhanced integrity and possible reduced costs in repairing steel pipe.	On-going. No additional funding is required at this point.	\$12,922	\$15,018	\$15,018	\$10,128
OTD-10	(2.7.h) Complete - Strategy for Elemental Sulfur Deposits in Gas Pipelines (SvWG Initiated Project)	GTI	A review and evaluation of elemental sulfur powder deposit in gas pipeline equipment.	Enhanced safety and reliability by better understanding root cause of sulfur deposits. In addition, possible reduced costs in addressing/ resolving deposits.	Final report available.	\$25,000	\$44,000	(\$15,719)	\$0
OTD-11	(2.8.c) Electrotorsion Coupling Guidelines	GTI	Extensive work has been done to develop the electrotorsion (EF) joining process and to investigate both the coupling joint. However, a great deal of dimensional variation can exist due to differences in the coupling onto the pipe tolerances, tooling, and installer practices. Current industry standards for EF couplings place no limitations on the coupling I.D. tolerances. The objective of this annular gap issues, develop guidelines to address these	Improved joining procedures and/or joint evaluation, to ensure long term joint integrity.	On-going. No additional funding is required at this point.	\$5,000	\$0	\$0	\$15,000
OTD-12	(2.9.e) HP stopping equipment	GTI	To develop "high pressure" inflatable stoppers as an alternative to currently employed stopping equipment for routine and emergency stopping operations on pipe systems such as cast iron, PE, and PVC. New challenging equipment can address situations. In addition, inflatable stoppers could save significant time and money during day to day operations.	Reduced costs in emergency stopping operations.	On-going.	\$0	\$0	\$0	\$0

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OTD-13	(4.5.d) Complete - Monitor Internal Corrosion Using Fluidized Sensors	GTI	The objective of this project is to develop sensors and delivery package that can be introduced into the gas stream and identify likely locations of internal corrosion as they flow through the pipeline. This type of information would reduce the total number of required excavations for internal corrosion assessment or eliminate the need to excavate the pipe altogether.	Reduced costs in detecting internal corrosion areas.	Final report available.	\$25,000	\$4,997			(\$1,903)
OTD-14	(4.6.a) Repair Techniques for Low Stress Pipelines	GTI	Testing and assessment of various repair techniques will be conducted to help provide justification for their use as long term repair methods on low stress pipelines allowed by CFR 49 Part 192. Results may help reduce the cost of repairing the steel pipelines by minimizing the need to cut full sections of pipe to make repairs.	Enhanced integrity and possible reduced costs in repairing steel pipe.	PHMSA has co-funded this project at ~ \$381,300. Testing and evaluation is complete and a final report is expected by mid 2010. No additional funding from SWG is required at this point.	\$25,000	\$10,714	\$22,551	\$0	
OTD-15	(4.6.b) Complete - Risk-Based DIMP Procedure for Plastic Gas Pipelines	GTI	The primary objective of this project is to develop a risk-based distribution integrity management procedure and software for companies to manage their plastic distribution pipelines.	Improved process for assessing plastic pipe risks.	(PHMSA Co-funded, \$494K). Results utilized in broader DIMP model.	\$25,000	\$13,900	\$12,790		
OTD-16	(4.7.a) Complete, In-Field Corrosion Rate Measurement for IMP	GTI	The purpose of this project is to provide a systematic and simple method to measure the general corrosion rate of steel or cast iron materials in the field and to collect and measure key soil and environmental parameters responsible for pitting/localized corrosion for a pipeline region/system. These sets of data (with select pre-assessment data) will be entered into a simple computer program/spreadsheet that combines the measured and collected data with historical/statistical data and provides a realistic corrosion growth rate to calculate reassessment intervals.	More efficient method for determining corrosion rates.	Final report available. In-field measurement process developed. Results support SVG's current process and identified areas for improvement.	\$30,000	\$38,923			
OTD-17	(4.7.f) Internal inspection sensor and platform for Explorer II (robot for 6"8")	NYSEARCH	See description under 4.3 below. This is the same effort but was funded under a separate OTD line item. Efforts under this funding is complete.	Application of a new technology to help meet PHMSA's integrity management regulations. In addition, possible reduced assessment costs for steel transmission pipe.					\$25,000	

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OTD-18	(4.7.g) Yield Strength Determination using pipe coupons	GTI	Federal safety regulations establish a minimum yield strength of steel pipe at 25,000 psi if the specifications of the steel pipe are unknown. Current methods to determine actual yield strength are cumbersome in that a pipe section is removed, which typically requires the pipeline to be taken out of service. This project is evaluating the determination of yield strength from small pipe coupons that do not require the pipeline to be taken out of service. If successful, the process developed will provide SWG a more economic option to determine yield strength which would allow SWG to more appropriately address the risks posed by the pipeline.	Reduced costs in determining actual yield strength of in-service pipe.	No cost time extension. Initial testing did not support full correlation between coupons and actual yield strength. However, additional analysis continuing.	\$17,000	\$15,941	\$10,000		
OTD-19	(4.8.a) Guided Wave Validation as Hydro Equivalent	GTI	Guided wave technology is being used to assess steel transmission pipe in casings as a result of federal transmission pipeline integrity regulations. Federal regulators however, are uncertain of the effectiveness and limitations of the technology. The purpose of this project is to compare the defects identified by guided wave technology to those identified in a pressure test (typically conducted as a hydro/water test). Pressure testing is currently accepted by federal regulators as an assessment technology.	Enhanced safety and integrity of transmission facilities covered under PHMSA's integrity management regulation through the appropriate use of guided wave technology. In addition, possible reduced costs to meeting regulations.		\$25,000	\$19,036			

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OTD-20	(4.8.g) GTI/NYSEARCH North American Casing Program (GTI Project)	GTI	All steel pipe in casings that fall within the scope of federal transmission pipeline integrity management regulations, have to be assessed by December 2012. Pipelines in casing are challenging to assess because they are often un-piggable, can not be taken out of service to conduct a pressure test, and have limited external corrosion direct assessment tools that are applicable. The intent of this program is to identify and conduct research projects through the collaboration of all stakeholders that include pipeline operators, federal and state regulators, research organizations, and manufacturers and service providers.	Enhanced safety and integrity of transmission facilities covered under PHMSA's integrity management regulation through the appropriate use of casing assessment methodologies. In addition, possible reduced costs to meeting regulations.	On-going. No additional funding is required at this point.	\$15,000				
OTD-21	(4.8.i) Extended Reassessment Interval Validation Through Dielectric Wax Casing Fill	GTI/Profile	To develop in-situ corrosion monitoring techniques and validation testing associated with the use of dielectric wax used to fill a casing. Monitoring techniques will be used for determining corrosion growth rate and for ensuring the quality and long-term performance of the wax fill. The results of the monitoring techniques could be used to help justify an extend re-assessment intervals for confirmatory direct assessment under integrity management regulations.	Improved understanding of affects of wax fills on corrosion rates. Possible reduced costs to meeting PHMSA integrity management regulations.	On-going	\$10,000	\$9,333	\$7,033		
OTD-22	(4.9.a) Increase Trmn. Boundary 20->30% SMYS	GTI	This project attempts to verify that a lower boundary of 20% SMYS for transmission classification is overly conservative. The work in this project will involve an international incident review and mathematical modeling (if necessary) to demonstrate that a lower boundary of 30% SMYS is more representative of actual leak vs rupture failures. The overall objective of the project will be to provide regulators and operators with information based on sound engineering principles that allows the selection of the most appropriate integrity management process.	Better understanding of risks and consequences of failures on lower stressed transmission pipelines. Results could provide a basis to reduce PHMSA integrity management requirements, thus reducing costs, without sacrificing safety.	On-going				\$19,000	\$13,963

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OTD-23	(4.9.b) 2" Camera for Live Gas Internal Inspection	TBD	To identify, develop, and/or demonstrate the use of a camera for the internal inspection of 2-inch gas mains without having to shut off the flow of gas and segment the pipe. This will be done by identifying a capable camera and then, working with the manufacturer, making modifications (if necessary) for live gas use. Fittings will also be reviewed and developed if necessary. The device and fittings will be capable of inspecting 2-inch and larger PE, PVC, steel, or cast iron mains.	Reduced costs for inspecting 2" gas mains.	On-going			\$15,000	\$20,000	
OTD-24	(4.10.a) 4" MFIL Tethered Inspection Tool for Unpigable Pipe	GTI	A tethered 4" MFIL tool capable of entering transmission pipe in live conditions has been developed but not fully demonstrated. In addition, no efforts have been pursued for a similar tool for larger pipe sizes (6" - 12"). If this technology is effective, then it could help utilities inspect transmission pipe in casings that fall under the PHMSA integrity management rules. This particular effort includes the demonstration of the 4" tool.	Application of a new technology to help meet PHMSA's integrity management regulations. In addition, possible reduced assessment costs for steel transmission pipe.				\$25,000		
OTD-25	(4.e) Inspection Platforms for Unpigable Pipelines (NYSEARCH)	NYSEARCH	This is a NYSEARCH effort that is being funded with OTD funds. There are 2 NYSEARCH robotics inspection tools for un-piggable pipe, included in these efforts. One is the development of an Explorer II robot that utilizes an Remote Field Eddy Current (RFEC) sensor for 6" - 8" pipe. The other is for the TiGRe robot that is for 22" - 24" pipe and utilizes MFIL technology. Both efforts were initiated due to transmission integrity management regulations promulgated by PHMSA. Distributions companies like SWG operate transmission pipelines that can not accommodate traditional in-line inspection tools (i.e. smart pigs).	Application of a new technology to help meet PHMSA's integrity management regulations. In addition, possible reduced assessment costs for steel transmission pipe.			\$105,000	\$111,484	\$86,923	

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OTD-26	(5.6.c) Complete - Field Collection of Mapping and GIS Information Using GPS Coordinates; Phase 2	GTI	The objective of this project is to develop a system that automatically collects digital mapping and GIS data during routine operations (locates, leak survey, corrosion monitoring, meter reading). This will be accomplished by implementing methodologies and software to attach GPS coordinates to field data. The field data will be collected using an "electronic work ticket" that geo-codes the data with no additional operator effort.	Evaluation of processes that may help reduce costs in updating mapping systems.	\$1,000				
OTD-27	(5.6.e) Complete. Portable Propane Air Residential Temporary Gas Supply	GTI	The purpose of this project is to research, design, prototype, test, and commercialize a portable Propane-Air system for use as a temporary gas supply on residential applications.	New device that can keep customers in-service during maintenance to gas facilities.	\$10,000	\$8,404			
OTD-28	(5.7.a) Re-Coating with Minimal or No Surface Preparation for Vaults and Other High Moisture Environments (SWG Initiated Project)	GTI	The project will research/develop a coating system that can be applied over gas piping with little or no surface preparation that will prevent atmospheric corrosion.	Reduced costs by reducing the amount of work required to re-coat pipe.			\$45,000	\$40,645	
OTD-29	(5.7.c) Complete - (5.7.c) Guidelines for Use of Copper Clad Steel Wire	GTI	The objective of this project is to test and evaluate Copper Clad Steel (CCS) tracer wire under laboratory and field conditions, examine the properties of the wire to develop installation methods, develop an installed wire comparison to copper wire, and to provide guidelines for the use of copper clad steel tracer.	Reduced costs by utilizing an alternative material to copper.			\$25,000	\$18,421	
OTD-30	(5.7.f) Automated Meter Shut-Off Device (AMS)	GTI	This project will develop an automated meter shut-off (AMS) device that would fit over the current meter shut-off valve (existing meter inlet valve) without the need to interrupt gas supply to the customer. Upon remote actuation of the battery powered device releasing the rotary actuator (via ltron type device or drive by vehicle) the AMS will close the gas meter inlet valve, stopping the flow of gas through the meter.	Reduced costs in installing a remote shut off device.			\$5,000	\$4,519	
OTD-31	(5.7.i) Complete - Integrating Radio Frequency Identification (RFID) into Daily Gas Operations	GTI	The overall project objective is to demonstrate that the uses of direct burial RFID can save considerable time and effort in daily utility operations for a very modest cost.	Reduced costs in data collection processes.			\$5,000		

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OTD-32	(5.6.q) Complete - EFV testing	GTI	Starting in June of 2008, all natural gas service lines to certain types of services will be required to have an excess flow valve (EFV) installed. This is a result of a new federal pipeline safety regulation issued in 2007. The purpose of this project is to conduct independent testing and analysis of various EFP's to help operators determine the most appropriate EFP's to utilize in their distribution systems.	Enhanced safety through the selection of appropriate EFP types. Final report available.		\$30,000	\$26,933			
OTD-33	(5.7.p) GPS Consortium (GTI Project)	GTI	The objective of the GPS Consortium Program is to facilitate technology transfer regarding the use of GPS technology for utility operations. The program activities include demonstrations, identification of research needs, workshops, pilot projects, best practices/standards development and general information sharing. A key focus is to establish standards or best practices for GPS data collection and GIS integration processes.	Reduced costs in implementing new GPS and GIS systems or devices. On-going. No additional funding is required at this point.		\$15,000		\$15,000		
OTD-34	(5.8.b) Complete - Study of Anode Life Effectiveness (SWG Initiated Project)	GTI	The intent of this project is to identify the various factors affecting the life of one pound anodes utilized in isolated steel services in AZ.	Enhanced safety through the appropriate specification and application of anodes. Final report available. Provides more insight on anode life in various conditions.			\$30,000			
OTD-35	(5.8.e) Development of Standardized Algorithms and Identifiers for Enhanced Material Tracking and Traceability	GTI	The purpose of this project is to develop a series of protocols that can be used effectively by gas distribution companies to more accurately track their underground facilities. The protocols will be developed from standardized algorithms and identifiers to characterize the various components within the gas distribution network (pipe, fittings, and appurtenances). These are then to be integrated within a utility's procurement, design, build, and construction process. Material traceability is important, particularly in the event that products are identified with defects that may affect the integrity of the system.	Standardized traceability among major gas carrying component manufacturers. This could help reduce costs associated with establishing internal tracking processes. On-going		\$15,000	\$10,798	\$8,000		

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OTD-36	(5.8.n) Complete - Quality Assurance Remote Management (QARM) - GPS Cameras for Joint Inspection	GTI	The objective of this program is to identify and develop procedures and tools to allow inspectors and management to monitor the quality of field operations remotely. This program will identify key elements to consider if implementing the use of cameras to photograph plastic joining operations as a means of recording visual inspections.	Enhanced inspection reporting.	No final report. Demonstrated opportunities for using GPS cameras for field inspection.	\$10,000				
OTD-37	(5.9.c) Mitigating Electrical Interference on CP Systems	GTI	To identify or develop practices that mitigate the effects of electrical interference on cathodic protection (CP) and telemetry systems. In addition to steady state AC interference, transient conditions such as power line faults and lightning strikes will be examined. The evidence for corrosion or damage that is caused by AC interference will also be examined. This project will focus on particular areas evident to LDCCs, such as those related to light-rail systems or underground high voltage electric lines.	Enhanced safety by mitigating interference on CP systems. Also, possible reduced costs in mitigating interference.	On-going				\$20,000	\$19,980
OTD-38	(5.9.j) Gas Distribution Model (GTI Project)	GTI	The objective of this program is to develop an industry data model and standards for natural gas distribution operators to reduce the cost of software implementation, increase interoperability, and improve data collection efforts. The Gas Distribution Model (GDM) and standards will specify the data structure for operations, assets, field data collection, and regulatory compliance without requiring operators to restructure their existing data model.	Standardized approach in creating distribution risk models. This could help reduce costs in establishing or implementing various types of risk models.	On-going. No additional funding is required at this point.				\$5,000	
OTD-39	(6.6.a) Keyhole Project	GTI	Keyhole technology provides access to buried pipelines through a hole approximately 18" in diameter. This small size has many advantages including, lower excavation costs and minimal impact and restoration to pavement. This program evaluates and demonstrates new applications for keyhole technology.	Reduced excavation and restoration costs.	On-going				\$20,000	\$20,000

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OTD-40	(6.8.a) GTI Carbon Management Initiative (GTI Project)	GTI	The CMIC is intended to serve as a clearinghouse for relevant carbon management information and to develop, where necessary, credible information products and functional tools to meet the needs of investors and their customers. Some deliverables for 2008 include a public-access and members-only website containing technical reports and information on products and a database of energy use profiles of gas, oil and electric end-use technologies for residential and commercial markets.	Better understanding of the role natural gas end-use equipment has in reducing overall energy use and in reducing green house gas emissions (i.e. CO2).  On-going			\$25,000	\$25,000	\$25,000	\$25,000
OTD-41	(6.8.c) Complete - Study on Direct Use of Nat. Gas to Reduce CO2 (GTI Project)	GTI	The goal of the program is to provide credible, defensible technical information on the benefits and costs of direct use of natural gas in residential, commercial, and industrial markets to reduce greenhouse gas emissions. The approach to achieve that goal in this program is to perform scenario analyses using the National Energy Modeling System (NEMS), the economy-wide, integrated energy model used by the Energy Information Administration to provide energy market and infrastructure projections to 2030.	Better understanding of the role natural gas end-use equipment has in reducing overall energy use and in reducing green house gas emissions (i.e. CO2).  Final report available. Provides insight on benefits of the direct use of natural gas to reduce CO2			\$5,000			
OTD-42	(7.7.b) Complete - Evaluating Distribution Greenhouse Gas Sources, including Field Measurement Program	Other	This project to be completed by Innovative Environmental Solutions, Inc. (IES), will improve high priority greenhouse gas (GHG) emissions factors (EFs), for estimation of GHGs from measurement and regulation facilities. The emission factors investigated will be determined based on input from project investors and the results of an AGA collaborative project with INGAA and API that prioritized GHG emission factors for natural gas systems.	Enhanced standardized GHG emissions reporting. Also, possible reduction in costs associated with tabulating GHG emissions from distribution systems.  Final report available. Provides new information for SWG to better estimate GHG sources, particularly at metering and regulating facilities.			\$15,000	\$14,448		

Ref. Number	Organization/Project Name	Research Performer	Project Description	Potential Benefits to AZ Customers	Status	Apr. '06 - Mar. '07 Funding	Apr. '07 - Mar. '08 Funding	Apr. '08 - Mar. '09 Funding	Apr. '09 - Mar. '10 Funding	Apr. '10 - Mar. '11 Funding
OTD-43	(7.7.d) Complete Biogas: Guidance for Dairy Waste (GTI Project)	GTI	Biogas from dairy cow waste can be processed and utilized as a renewable energy. The objective of this project is to help develop a basis for a national standard on the quality of biogas for acceptance into natural gas pipeline systems. This project will assess and document available domestic and international information to develop a broader knowledge base related to biogas production, gas treatment, gas quality standards, and gas quality test protocols. In addition, it will develop and execute a laboratory-testing program to evaluate raw (before cleanup) and post-cleanup biogas in order to assess quality, safety, and compatibility with existing supplies, pipeline delivery infrastructure, and customer end use equipment.	Reduction in overall green house gas emissions through the use of renewable gas. Also, local supply of gas may help reduce gas costs to customers.	Final report available. Provides significant information on manufacturing biogas, and constituents to address before accepting as pipeline quality gas.	\$20,000	\$3,000			
OTD-44	(7.8.a) (GTI) Biogas: Guidance for Landfill and Water Treatment Facilities	GTI	This project is primarily being funded by the U.S. Department of Transportation's Pipeline and Hazardous Material Safety Administration (DOT/PHMSA). This project attempts to develop guidance on requirements on accepting biogas from landfills and waste water treatment facilities into natural gas pipelines. This project will include a sample collection and data analysis program to include up to a total of 90 samples (40 raw/20 clean landfill gas, 10 raw/10 clean wastewater treatment biogas and 10 natural gas samples).	Reduction in overall green house gas emissions through the use of renewable gas. Also, local supply of gas may help reduce gas costs to customers.	On-going (PHMSA Co-funded project, \$638K). Funding may be required in 2010-2011, but not at this point.	\$15,000				
OTD-45	(7.9.c) Biogas: Siloxane Concentrations, Phase I (GTI Project)	GTI	The objective of this project is to initiate the assessment and documentation to help prepare guidance material on acceptable levels of siloxane in biogas, mainly from landfills and wastewater treatment plants. This project is aimed at developing a detailed test program for determining acceptable siloxane levels.	Reduction in overall green house gas emissions through the use of renewable gas. Also, local supply of gas may help reduce gas costs to customers.	New, Jan. 2010	\$0	\$10,000			

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OTD-46	(7.9.d) Improving Methane Emission Estimates for LDCs - Phase I	GTI/Health	This is in relation to OTD project 7.7.b which addressed pipeline measurement and regulation equipment. This 7.9.d project address emissions from pipelines. Current estimation methodologies for quantifying fugitive and vented methane emissions are broad based and may over or under estimate actual emissions based on an operators pipeline system characteristics. The resulting emission methodologies should ultimately be integrated with existing gas distribution software and system tools to allow for convenient implementation and reasonable methane emissions management practices.	Enhanced standardized GHG emissions reporting. Also, possible reduction in costs associated with tabulating GHG emissions from distribution systems.	SWG hosted field testing of leak rate sampling at EMRF facility in Nov. 2009 in Henderson	\$15,000	\$2,292			
OTD-47	(7.9.e) Biogas: Portable Package for On-site Analysis	GTI	The objective of this project is to develop a cost-effective portable (skid-mounted or smaller) analytical package (instrumentation or surrogate analytical techniques) for biomethane.	Project cancelled			\$0			
OTD-48	(7.10.a) Trace Constituents Phase I (GTI Project)	GTI	The purpose of the overall study (Phase I and Phase II) is to more fully understand the trace constituent profile in natural gas, so that more accurate comparison of renewable natural gas with existing natural gas supplies may be facilitated. The natural gas industry will benefit from this study because an updated analytical profile of trace constituents will be amassed, through a sampling and analysis program of natural gas samples collected throughout various regions in the US.	Reduction in overall green house gas emissions through the use of renewable gas. Also, local supply of gas may help reduce gas costs to customers.	New. March 2010				\$5,000	
OTD-49	(7.10.b) Odor Fade Guidelines (GTI Project)	GTI	The goal of the project will be to provide a "Practical Pipeline Operator Guide" to manage odor fade issues associated with typical gas system operating conditions and materials of construction.. This will include a tested methodology to validate additional combinations of Gas, System, and Material scenarios.	Enhanced safety through the appropriate specification and procedures for ensuring sufficient odorant in distribution systems.	New. March 2010				\$10,000	
						Credits	OTD Balance			
						\$161,500	\$676,128	\$420,758	\$311,190	\$322,069
						\$208,500	\$91,360	\$15,082	\$233,892	\$127,331

Ref. Number	Organization/Project Name	Research Performer	Project Description	Potential Benefits to A2Z Customers	Status	Apr.'06 - Mar.'07 Funding	Apr.'07 - Mar.'08 Funding	Apr.'08 - Mar.'09 Funding	Apr.'09 - Mar.'10 Funding	Apr.'10 - Mar.'11 Funding
NYS-1	<b>NYSEARCH Membership Dues</b>		Natural gas received as LNG import gas, has different gas quality characteristics as compared to the natural gas historically received from North American supplies (US and Canada). Import LNG is typically "drier" and hotter than domestic supplies. This dry gas has been identified as a potential cause of leaks in mechanical fittings due to the drying of the elastomers. This study will evaluate various compositions of "dry" natural gas to elastomers used in various types of mechanical fittings.	Enhanced safety through the use of appropriate interchangeability standards/guidelines for new sources of natural gas.	Final report available for first phase. (\$WG only funded first phase)	\$37,500	\$12,400	\$67,150	\$40,000	\$40,000
NYS-2	<b>Complete - Effect of Gas Quality Changes on Pipeline Components</b>	GTI	The purpose of this effort is to test and evaluate a specific guided wave ultrasonic tool utilized by SWG. At the time of this evaluation, PHMSA did not establish rigorous guidelines for the use of such tools.	Enhanced safety and integrity of transmission facilities covered under PHMSA's integrity management regulation through the appropriate use of guided wave technology. In addition, possible reduced costs to meeting regulations.	Final Report available. Demonstration of Guided Wave tool utilized by SWG help validate use of the technology.	\$27,600				
NYS-3	<b>Demonstration - Long Range Ultrasonic tool at NYSEARCH test bed</b>	NYSEARCH	The objective of this project is to determine resistance of polyethylene pipe to rock impingement. New grades of plastic pipe have appeared to more resistant to rock impingement but no thorough evaluations have been conducted.	Enhanced safety and integrity of PE pipe through improved pipe installation procedures (if required)	On-going	\$12,140				
NYS-4	<b>Rock Impingement resistance of PE pipe</b>	Hessel Labs	This work is being done in conjunction with project OTD-6 (2.7.b) related to lateral joint integrity. A controlled butt heat fusion process will be developed on the basis of comprehensive testing and evaluation using novel test methodologies in order to validate the safe long term performance of PE butt fusion joints over their intended design life. The process will take into account actual in-service stress states through comprehensive computer modeling and empirical testing. Criteria will then be developed to identify suspect joint via short and long term testing. Finally, key criteria for existing and future NDE technologies will be identified.	Improved joining procedures and/or joint evaluation, to ensure long term joint integrity.	On-Going (PHMSA Co-funded \$312K). No additional funding required at this point.	\$13,450				\$26,485

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NYS-5	Complete - Casing assessment technologies		To develop & share information about the performance of inspection technologies on cased pipe in live field applications. Five service providers using 2 types of guided wave technologies will evaluate similar pipe segments.	Enhanced safety and integrity of transmission facilities covered under PHMSA's integrity management regulation through the appropriate use of casing assessment methodologies. In addition, possible reduced costs to meeting regulations.	More insight obtained on assessment technology applications and limitations.	\$33,955				
NYS-6	Gas Quality Impact on Residential Appliances	Enviro/GTI	Natural gas received as LNG import gas, has different gas quality characteristics as compared to the natural gas historically received from North American supplies (US and Canada). Import LNG is typically "drier" and hotter than domestic supplies. The impact of the changes in gas quality to residential appliances has been known to cause some safety issues because gas burners are adjusted for a certain range of gas quality specifications. The intent of this project is to help identify the effects of varying gas quality in residential appliances.	Enhanced safety through the use of appropriate interchangeability standards/guidelines for new sources of natural gas.	On-going			\$35,425		
NYS-7	Complete - 3rd Party Detection and Damage	Magal	This effort will evaluate technologies that can be applied to third party monitoring that were developed by Magal Sensor Inc. The applications are: 1) PipeGuard – consist of sensing units that consist of geophones buried 3 feet below grade to sense third party intrusions, 2) Dreambox – a video analytics platform that uses cameras to detect and alarm when it recognizes images of excavating equipment. The intent is to determine if these technologies are effective and practical to apply to pipeline monitoring to help prevent 3rd party damage.	Enhanced safety through the identification of 3rd party threats to pipelines.					\$9,360	

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NYS-8	Casing risk assessment methodology (M2001-003-B, Phase III)	Malbauer	Integrity management regulations require that transmission pipeline in casings in high consequence areas be assessed. The challenge with casings for distribution companies, is that ECDA and ILI tools are not feasible to utilize. The objectives of the proposed project are to: 1) develop a simple tool for making data validated decisions on assessment or monitoring of cased pipes in HCAs, and, 2) allow a streamlined and formal approach for prioritizing casings inspection activities that can be integrated with other benchmarking and technology developments for this purpose.	Standardized approach to assessing risk of casings. Possible reduced costs in conducting risk analysis of casings.	On-Going				\$4,440	
NYS-9	Explorer Demonstration in AZ (robotics demo)	Innovandate	The objective of this effort is to field demonstrate the Explorer II inline inspection robot in a SWIG 8" transmission pipeline facility in Phoenix. This is one of the tools we are funding under OTD-17 and OTD-25 above. The approximate length of the demonstration would include about 3,000 feet of pipe. The sensor technology is a Remote Field Eddy Current (RFEC) which is not commercially used in the industry (i.e. standard is MFL).	Application of a new technology to help meet PHMSA's integrity management regulations. In addition, possible reduced assessment costs.					\$0	\$65,000
NYS-10	NDE inspection technology for PE fusions joints	TWI	The key objective of this effort are to determine the detection capabilities of TWI's existing NDE equipment for 4" and 8" PE butt fusions. In addition, this effort intends to determine critical flaw sizes that impact long term integrity of butt fusion joints. Finally, this effort will include the manufacturing of a new prototype system(s) that will be demonstrated at various utilities.	Enhanced safety and integrity through detection of defective fusion joints.	On-going				\$28,000	
<b>Subtotal NYSEARCH Allocation</b>										<b>\$133,000</b>
<b>Subtotal NYSEARCH Allocation</b>										<b>\$70,925</b>

Ref. Number	Organization/Project Name	Research Performer	Project Description	Potential Benefits to AZ Customers	Status	Apr. '06 - Mar. '07 Funding	Apr. '07 - Mar. '08 Funding	Apr. '08 - Mar. '09 Funding	Apr. '09 - Mar. '10 Funding	Apr. '10 - Mar. '11 Funding
<b>American Gas Foundation (AGF)</b>										
AGF-1	Complete - Study on Research and Development in Natural Gas Transmission and Distribution	GOIA	This effort will consist of a comprehensive review of past and current RD&D funding and programs for the natural gas transmission and distribution pipelines.	Better understanding of RD&D organizations and efforts which will help SWG in managing AZ customer RD&D dollars.	Final report available. Information obtained to help shape SWG RD&D program.	\$15,000	\$0			
AGF-2	Bldg. Energy Codes and Stds. Research	Misc.	Natural gas safety standards and guidelines that apply to facilities downstream of the meter, are critical in helping ensure that natural gas is used safely in buildings and residences. This effort helps provide technical research to support changes to codes and standards.	Enhanced safety in the utilization and application of natural gas equipment.	On-going	\$25,000	\$0			
<b>Subtotal AGF Allocation</b>										
<b>\$40,000</b>										
<b>Managed by EETD</b>										
EETD-1	Gas Engine Driven Heat Pump Water Heater		A natural gas engine driven heat pump can be utilized for hot water heating which would increase the total energy efficiency as compared to current natural gas or electric water heaters. This development would be a multiple year project including phases for research, bread boards, prototyping, site verification and installation.	Such a product would provide an opportunity to replace existing inefficient water heaters and provide a better energy alternative for new construction buildings.	Final reports available (phase I and II). Demonstrated feasibility of technology.	\$46,737	\$100,000			\$1,242
EETD-2	Solar Air Conditioning with Natural Gas back-up		This solar demonstration project will illustrate the value of utilizing solar energy to cool homes, supermarkets, office buildings, factories, etc. Solar will be the primary energy source with natural gas as the back-up. Solar energy would be utilized during daylight hours and natural gas at night or on cloudy days. The purpose of this solar air conditioning demonstration is to show the significant environmental benefits and consumer energy savings potential of the technology.	A possible more efficient, effective and environmentally friendly way to air condition buildings.	System installed and operational in Tempe, AZ. Next phase will evaluate system performance.	\$28,017	\$85,000	\$131,253	\$3,000	

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EETD-3	CO <sub>2</sub> sensor for industrial natural gas boilers		A small number of larger boilers with output >10 million BTUs, use oxygen and carbon monoxide (CO) sensors to calculate hydrocarbon and CO <sub>2</sub> levels, to optimize combustion. The recent advent of a novel gas sensor technology platform capable of producing low cost sensors that can measure directly flue hydrocarbon and CO <sub>2</sub> levels, offers an alternate and better method for maximizing combustion efficiency for gas burners. The purpose of this project would be to determine the applicability and feasibility of utilizing this new sensor for existing boilers, to improve the overall efficiency.	Project cancelled		\$0				
EETD-4	Solar Thermal Domestic Water Heating and Hydronic Space Heating with Natural Gas Backup		The solar thermal domestic water heating and hydronic space heating project will demonstrate the efficient use of solar energy and natural gas to meet the day to day hot water and space heating demands of single family homes. The solar thermal energy will be used as the primary energy source and natural gas will be used as the backup or secondary energy source.	Demonstrates the potential natural gas savings from the use of solar thermal systems.				\$4,228	\$3,000	
EETD-5	Gas Engine Driven Heat Pump - Generator Addition for Plug-in Hybrid		Natural gas engine driven heat pumps are currently being commercialized in AZ. The engine utilized in these heat pumps can be utilized to drive an electric generator, which could then be utilized to help charge a plug-in hybrid. Some effort has already been initiated in this regard, and this funding would help further evaluate appropriate generators and plug-in vehicle charging requirements.	Demonstrates the potential for further development of commercial gas heat pumps providing plug-in vehicle charging. This would help SWG AZ customers with plug-in vehicles reduce their overall electric grid requirements to charge their vehicles.				\$0		
EETD-6	GHP Prototype w/Stirling Engine combined with EHP (Deluge and 10-ton EHP 13 SEER)		The objective of this project is to evaluate whether additional efficiencies can be gained from overall GHP performance utilizing a stirling engine. A prototype unit will be developed using a sterling engine and an off the shelf 13 SEER electric heat pump. The sterling engine will utilize natural gas as a fuel source.	While this is a proof of concept effort, if proven feasible, such a product would provide additional efficiencies for gas cooling applications.					\$27,000	\$50,000

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EETD-7	Solar Thermal System Equipment Demo		An additional system will be installed for a commercial or residential application to further evaluate actual operations and energy usage from solar thermal systems. While manufacturers have published data on potential energy savings of solar thermal systems, actual savings varies significantly depending on application and use by customers. Evaluation of more systems are required to provide SWG customers a better estimate of potential savings. The location of the installation is yet to be determined.	Demonstrates the potential natural gas savings from the use of solar thermal systems.	New March 2010. Equipment being procured	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000
EETD-8	GHP Demonstration Project in AZ		The objective of this effort is to demonstrate the energy savings of GHP applications. This project would include the purchase and installation of GHPs at a SWG customer facility. Data monitoring equipment would be added.	Demonstrates potential overall building energy savings by the use of gas heat pumps.	New March/April 2010. Not started					\$200,000
<b>Subtotal EETD Allocation</b>						<b>\$74,754</b>	<b>\$185,000</b>	<b>\$149,830</b>	<b>\$178,723</b>	<b>\$271,000</b>

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<b>ASME Pipeline Research</b>									
ASME-1	Complete. Application Guide for Determining Yield Strength of In-Service Pipe Using Hardness Testing (Previously paid \$10K under O&M)		Federal safety regulations establish a minimum yield strength of steel pipe at 25,000 psi if the specifications of the steel pipe are unknown. Current methods to determine actual yield strength are cumbersome in that a pipe section is removed, which typically requires the pipeline to be taken out of service. This project evaluates the use of hardness testing which does not require a cut out of pipe sections, to correlate to the pipes yield strength. A significant portion of this effort will be to develop a field guide on how to use hardness testing to correlate to yield strength.	Reduced costs in determining actual yield strength of in-service pipe.	Final report available. Systematic approach developed to help determine yield strength of steel pipes with unknown properties.	\$10,000	\$0		
<b>Other</b>									
OTH-1	Research consultant - help manage projects, develop proposals	Campbell	SWG will utilize this outside consultant to help manage and/or stay abreast of projects funded. Consultant will also help SWG prepare research proposals, specific to SWG's needs, to present to various research organizations.	Helps provide input on projects funded by SWG to help ensure they are to the benefit of AZ customers. On-going		\$1,000	\$18,000	\$11,116	\$4,691
OTH-2	Safety Vest Evaluation/Testing	SWG	The objective of this project is to help identify appropriate safety vests for field use during natural gas emergencies. Safety vests require reflective coatings, however vests utilized by SWG have experienced color degradation as well as static charges. GTI will evaluate phenomenon behind issues and tests various vests on the market.	Enhanced safety through the application of appropriate safety vests.	New. March 2010				\$25,000
<b>Subtotal Other Allocation</b>						<b>\$1,000</b>	<b>\$18,000</b>	<b>\$11,116</b>	<b>\$4,691</b>
<b>Allocation Summary</b>									
Total Dollars Allocated	Apr '06 - Mar '07 Funding					Apr '08 - Mar '09 Funding	Apr '09 - Mar '10 Funding	Apr '10 - Mar '11 Funding	
Total Available Research Dollars	\$688,004					\$688,715	\$683,521	\$684,339	\$653,108
Available Dollars	\$688,712					\$688,712	\$683,903	\$688,276	
	<b>\$708</b>					<b>-\$3</b>	<b>-\$4,809</b>	<b>-\$4,436</b>	<b>\$35,168</b>

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**General Notes:**

<b>1</b>	Total authorized collection in Final Order is \$688,712 per year. Funding is collected in a deferred balancing account
<b>2</b>	Proposed projects reflected in current or proposed funding year may change. Some projects may terminate pending progress or proposed projects may not materialize due to lack of support. In addition, research organizations meet and discuss new and existing projects at various times of the year - this document reflects projects and information as of the date of this document.
<b>3</b>	Actual allocation amount may change due to changes in projects described in 2 above or due to number of companies that ultimately fund a project.